AUG - 9 1965

ONTARIO WATER

**ANNUAL REPORT 1964** 

# NORTH BAY

water pollution control plant

DIVISION OF PLANT OPERATIONS

Ontario Water Resources Commission

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#### ONTARIO WATER RESOURCES COMMISSION

OFFICE OF THE GENERAL MANAGER

Members of the North Bay Local Advisory Committee, City of North Bay.

#### Gentlemen:

We are pleased to provide you with the 1964 Operating Report for the North Bay Water Pollution Control Plant, OWRC Project No. 58-S-10.

By continuing the mutual cooperation which has existed in the past, we can look forward to greater progress in the field of water pollution control.

Yours very traily

D. S. Caverly, P. Eng.

General Manager



General Manager, Ontario Water Resources Commission.

Dear Sir:

It is with pleasure that I present to you the Annual Report of the operation of the North Bay Water Pollution Control Plant, OWRC Project No. 58-S-10 for 1964.

This report presents design data, outlines operating problems encountered and summarizes in tables, charts and graphs all significant flow and cost data.

Yours very truly,

Befalmer

B. C. Palmer, P. Eng.,

Director,

Division of Plant Operations.

#### FOREWORD

This report describes the operation of this project for the year 1964. It includes a detailed description of the project, summary of operation, graphs and charts showing quality and quantity information, and project cost data.

This information will be of value to the municipality in assessing the adequacy of the works in meeting existing requirements and in projecting its capability to meet future expected demands. The cost information will be of particular interest to those concerned with developing and maintaining revenue structures.

The preparation of this report has been a cooperative effort of several groups within the Division of Plant Operations. These include the Statistical Section, Brochures Officer and the Regional Supervisor. However, the primary responsibility for the content has been with the Regional Operations Engineer. He will be pleased to discuss all aspects of this report with the municipality.

B. C. Palmer, P. Eng., Director, Division of Plant Operations.

### CONTENTS

	Foreword	*					•			*				1
	Title Page		•											3
	64 Review													4
	Glossary					*								5
	History													6
	Project Staf	f												7
	Description	of	Pro	jec	et									8
	Project Cos	ts				٠								10
1	Plant Flow (	Cha	ırt			•							•	15
]	Design Data										•	•	•	17
]	Process Dat	a.							•	-	•	*	•	
														19

## NORTH BAY water pollution control plant

operated for

THE CITY OF NORTH BAY

by the

ONTARIO WATER RESOURCES COMMISSION

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W. S. MacDonnell

#### DIVISION OF PLANT OPERATIONS

DIRECTOR: B. C. Palmer

Assistant Director: C. W. Perry Regional Supervisor: D. A. McTavish Operations Engineer: M. B. Fielding

801 Bay Street Toronto 5

# 64 REVIEW

The flow to the North Bay Water Pollution Control Plant during 1964 averaged 3.39 mgd as compared to 3.38 mgd in 1963. The flow exceeded the plant design flow of 4.0 mgd 24% of the time as compared to 20% in 1963.

The strength of the influent sewage during 1964 was consistent with average sewage, having an average BOD of 157 ppm and an average suspended solids content of 250 ppm. The plant efficiency for the year was consistent with design expectations for the activated sludge process, giving reductions of 90.5% and 94.5% in BOD and suspended solids respectively.

The cost of operating during 1964 was \$72,953.91, representing a per capita cost to those persons using the system of \$1.84, or a cost of \$59.10 per million gallons of sewage treated. This compares favourably with other such plants in the province where the average cost of full treatment per million gallons is approximately \$99.

#### GLOSSARY

BOD biochemical oxygen demand (a measure of organic

content)

cfm cubic feet per minute

comminution shredding of solids into small fragments

DWF dry weather flow

effluent outflow

flocculation bringing very small particles together to form a larger

mass (the floc) before settling

fps feet per second

gpcd gallons per capita per day

gpm gallons per minute

grit sand, dust, stones, cinders and other heavy inorganic

material

influent inflow

lin. ft. lineal feet

mgd million gallons per day

mlss mixed liquor suspended solids

ppm parts per million

ss suspended solids

TDH total dynamic head (usually refers to pressure on a pump

when it is in operation)



#### INCEPTION

In 1956, the City of North Bay approached the Ontario Water Resources Commission to finance, construct and operate sewage treatment facilities in the municipality. After preliminary discussions were held, it was decided that a joint scheme, including the Townships of West Ferris and Widdifield would most adequately serve the needs of the area. The consulting engineering firm of Graham Reid and Associates Limited was engaged to prepare plans and specifications.

#### APPROVAL

At a public hearing on September 26th, 1958, the Ontario Municipal Board approved the integrated sewage works scheme.

#### CONSTRUCTION

The project, consisting of trunk sewers, manholes, appurtenances and an activated sludge sewage treatment plant, was divided into four contracts.

Stirling Construction was awarded the contract for the treatment plant. Beaver Construction and Midwestern Construction shared in the rest of the project.

Construction was substantially completed in the fall of 1960 and the sewage treatment plant was put into operation at that time.

Since the original project 58-S-10 was completed, an additional trunk sewer and metering pit was constructed for the Township of Widdifield as project No. 62-S-103. This feeds into the North Bay treatment plant.

#### TOTAL COST

The tentative total cost of the combined project was \$2,316,089.66.



STAN HEALEY SUPERINTENDENT

#### **Project Staff**

Mechanic Operator C

R. Lepage

Electrician Operator

A. Gauthier

Operators

G. Gerbasi

G. Sevigney

J. Sutherland

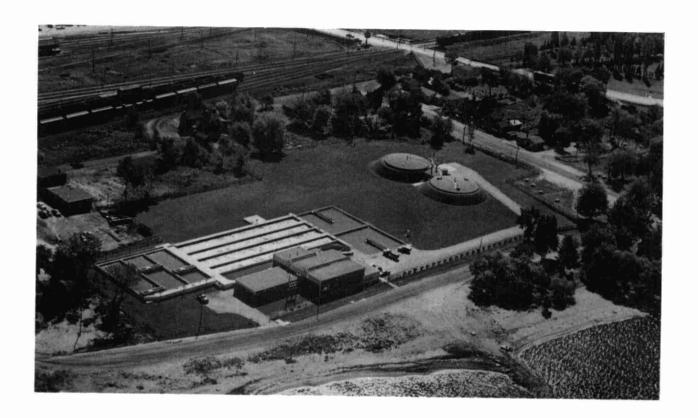
A. Garrett

#### COMMENTS

The plant is staffed by a Superintendent and six operators. Two of the operators are responsible for the electrical and mechanical maintenance with the remaining four operators being on shift. Trouble sensing devices installed at all critical points are connected to a central alarm located in the City Police Department. Upon activation of the alarm during the non-supervised period (midnight until 8:00 a.m.) the officer on duty will call a member of the plant staff who will rectify the problem.

Operators are required to do all grounds and building maintenance as well as ensure a high quality of plant effluent.

The operation of the project is supervised by the Division of Plant Operations through an Operations Engineer who makes periodic inspection visits. The services of the Electronics and Maintenance Sections of the Division are available to the Operations Engineer and they assist him and the staff in rectifying plant problems. The Maintenance Section made a complete mechanical and electrical inspection of the plant and pumping station and found everything in good order. All of these services, as well as other OWRC head office services, are at no charge to the municiaplity.



#### **Description of Project**

#### INFLUENT WORKS

From the influent manhole, the sewage flows into the influent works where the first degree of treatment is given. Grit is removed in two square parallel chambers where the velocity of the sewage is reduced to a point whereby grit and sand will settle out but most organic solids will The chambers are equipped with mechanical scrapers which gather the grit into the collector channels located beside the grit chambers. The collector channels are equipped with inclined rectangular dragout conveyors which discharge the grit into 45 gallon drums for removal.

Prior to entering the main plant wet well the sewage passes through two parallel Griductors which screen and cut organic solids and rags. In the event that the Griductors must be taken out of service. the plant is equipped with a bypass channel and coarse bar screen.

#### PRIMARY TREATMENT

From the wet well, the raw sewage is pumped into three primary sedimentation tanks where the sewage is held long enough to allow organic solids to settle out and form a sludge. This raw sludge collected by means of travelling scrapers which are mounted on carriages that travel back and forth on rails running the length of the tanks. On the forward pass, the scrapers push raw sludge to hoppers on the bottom at one end of the tank from which it is drawn off at regular intervals. On the return pass, scum or grease is skimmed from the surface and deposited in scum aprons at the opposite end of the tank to the sludge hoppers. Both raw sludge and scum are pumped to the primary digester. The partially treated sewage then flows over the weirs to the aeration section.

#### RAW SLUDGE THICKENING PIT

The raw sludge from the primary sedi-

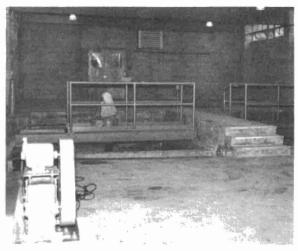
mentation tanks can be pumped to a thickening pit where excess water can be removed before pumping it to the digester. Due to odour problems with this tank, it has been taken out of service.

#### AERATION

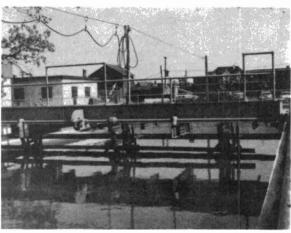
Sewage from the primary sedimentation tanks flows by gravity to four single pass aeration tanks where it is mixed with activated sludge that has been returned from the final sedimentation tanks. Air is injected into the tank through air diffusers near the tank bottom. blowers powered by gas engines provide this air, based on design flow, at a rate of 1.35 cubic feet per gallon of sewage. The biological floc produced in the aeration section requires food and oxygen. The sewage is the food source and the air is the oxygen source. Continual control is maintained on the aeration section by means of a routine sampling procedure. From the test results, the variables are adjusted to establish optimum conditions in this section.

#### FINAL SEDIMENTATION TANKS

The aerated mixed liquor from the aeration section is directed to two square final sedimentation tanks. There the floc is allowed to settle to the bottom and be collected by means of submerged rotary collectors. Some of the sludge is returned to the aeration section where



INFLUENT WORKS



PRIMARY SEDIMENTATION TANKS

it is instrumental in the activated sludge process. The rest is wasted to the primary sedimentation tank where it is removed with the raw sludge.

#### CHLORINE CONTACT CHAMBERS

The effluent from the final sedimentation tanks is chlorinated during the summer months as required by the Division of Sanitary Engineering of the OWRC. The final effluent is then discharged to Lake Nipissing, 1,000 feet from shore.

#### SLUDGE DIGESTION TANKS

The raw and waste activated sludges are pumped to the primary digester where they are mixed and maintained at about 90 Fahrenheit. The sludge digestion in this plant is of the anaerobic alkaline process. It is in the primary digester that the greatest proportion of sludge stabilization is achieved. sludge passes through the acid stage to the methane gas producing stage in which vast amounts of combustible methane gas are produced. This gas is used to heat the digesters and also as fuel for the gas engines which drive the blowers.

Sludge is transferred from the primary digester to the secondary digester where concentration of the solids is effected. The solids are pumped from the bottom of the secondary digester to a waiting tank truck for disposal. Supernatant is returned from the secondary digester to the primary sedimentation tanks.

# PROJECT COSTS

LONG TERM DEBT (Total Capital Cos	t):		
N. Bay City W. Ferris Twp. Widdifield Twp.		\$1,	242, 819. 22 891, 336. 24 181, 934. 20
TOTAL		\$2,	316,089,66
The total cost to the m	unicipality during	g 1964	was as follows:
NET OPERATING		\$	72,953,91
DEBT RETIREMENT			
N. Bay City W. Ferris Twp. Widdifield Twp.	\$25, 183. 35 17, 689. 86 3, 727. 14	\$	46,600.35
RESERVE			
N. Bay City W. Ferris Twp. Widdifield Twp.	\$10,797.94 7,118.93 998.35	\$	18,915.22
INTEREST CHARGED			
N. Bay City W. Ferris Twp. Widdifield Twp.	\$69,815.21 50,065.03 10,226.38	\$	130, 106. 62

\$ 268,516.10

TOTAL

#### RESERVE ACCOUNT

#### BALANCE AT JANUARY 1, 1964

BALANCE AT JANUA	RY 1, 1964	
N. Bay City W. Ferris Twp. Widdifield Twp.	\$31, 268. 13 18, 662. 77 2, 794. 53	\$ 52,725.43
DEPOSITED BY MUNI	CIPALITY	\$ 18,915.22
INTEREST EARNED		
N. Bay City W. Ferris Twp. Widdifield Twp.	\$ 1,964.93 1,191.47 166.08	\$ 3,322.48
		\$ 74,963.13
Less Expenditure	s	-
Balance at December	31, 1964	\$ 74,963.13
DEBT OUTSTANDING		
N. Bay City W. Ferris Twp. Widdifield Twp.		\$1, 129. 273. 35 807, 139. 02 167, 370. 43
		\$2, 103, 782, 80

#### MONTHLY COSTS

	T	T	T	T	T	T					
MONTH	TOTAL EXPENDITURE	PAYROLL	CASUAL PAYROLL	FUEL	POWER	CHEMICAL	GENERAL SUPPLIES	EQUIPMENT	REPAIRS 8 MAINTENANCE	* SUNDRY	WATER
JAN	4547.54	2288,63			486.99		129,98	76,22	326.35	828,56	410.8
FEB	4670.71	2334.43			651.45		317.09		43.11	1012.34	
MARCH	3801.91	2321.96		24.00	304.29		90.75	12,28	581.63	180,42	286.5
APRIL	9307.66	2752, 12		52.77	1397.05		104,35	46.68	70.98	4546.34	337.3
MAY	6736.12	3693.71			900,52		163.13	6.46	597 <b>.77</b>	1073.88	300.65
JUNE	9949.91	2689.07	212,82		816.87	3350,07	469,79	158,00	534.91	1228,92	489,46
JULY	4868,27	2472.90	283.76		879,58	(850,95)	192,92	14.57	598.31	988,46	288.72
AUG	6636,20	2191,66	395,76		822.01	1315.20	177,69		399.07	1084.03	250,78
SEPT	3058.19	2043,84	503,80		796,96	(1350.00)	115.57	48.57	268,20	380.48	250.47
ост	7715.63	2045.02	323,64		787.18		361.41	219.69	650.30	3241.63	86,76
NOV	5249,45	2145.07			757,70	(450.00)	280.39	11.97	304.31	2049.91	150,10
D€C	6412.32	3528.54			1423,58	(450.00)	411.65	79,53	656,31	726.71	36,00
TOTAL	72,953.91	30,506.95	1719.78	76.77	10,024.18	1564.32	2815.02	673,97	5031.25	17,341.68	3199.9

<sup>\*</sup> SUNDRY INCLUDES SLUDGE HAULING COSTS WHICH WERE \$13435.66
BRACKETS INDICATE CREDIT

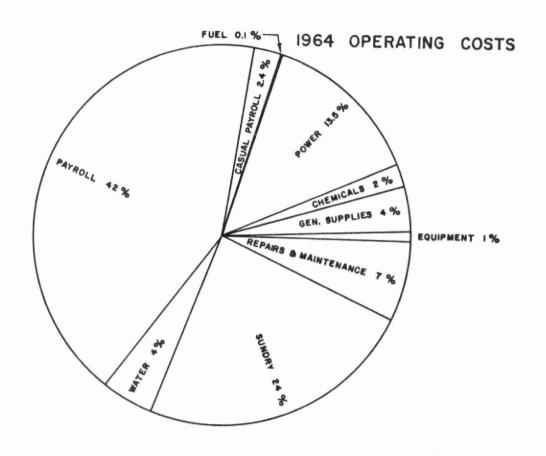
#### YEARLY COSTS

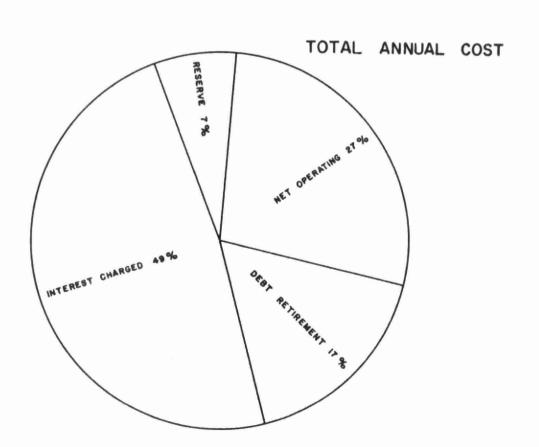
YEAR	M. G. TREATED	TOTAL COST	COST PER FAMILY PER YEAR	COST PER	COST PER L.B.
1961	1430.000	74,888.15	* 7.53	52.37	4 CENTS
1962	1118,630	68,352.13	6,82	61.09	6 CENTS
1963	1234,303	67,131.06	6,63	54,39	4 CENTS
1964	1234.328	72,953.91	12.17	59.10	4 CENTS

<sup>\*</sup> BASED ON ANNUAL POPULATION ESTIMATE AND 3.9 PERSONS PER FAMILY

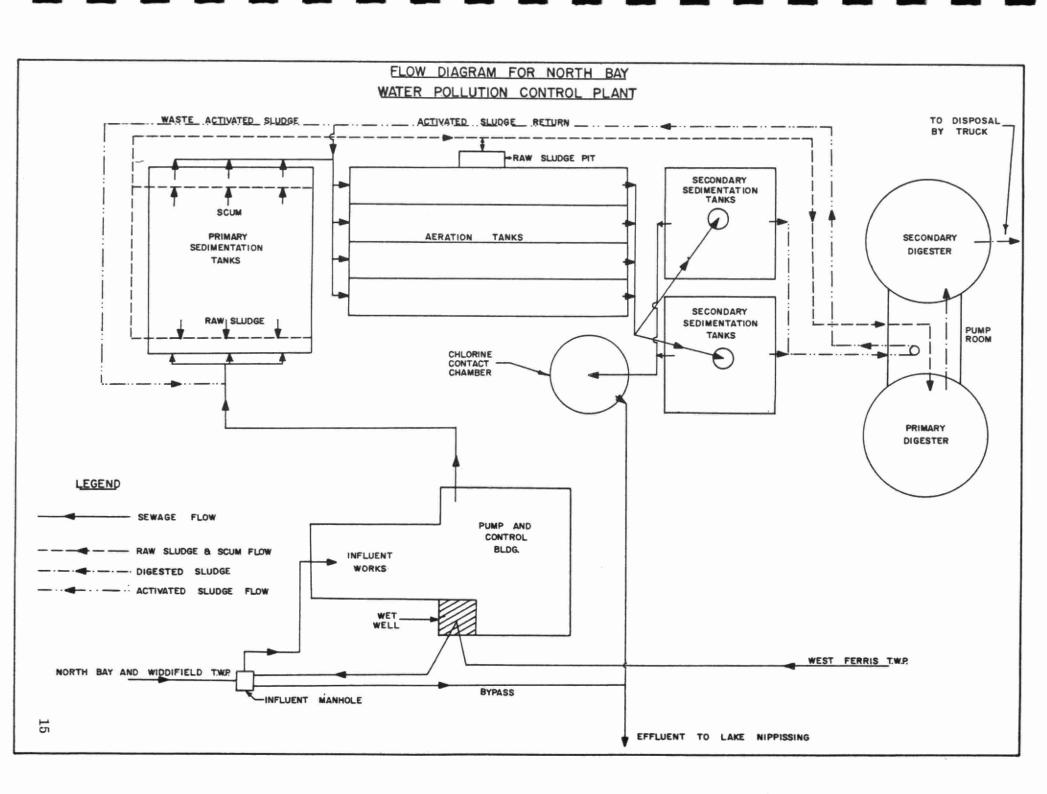
#### SUMMARY OF OPERATING EXPENSES

ITEM	1961 COST	1962 COST	1963 COST	1964 COST	1965 BUDGET
Payroll	\$ 26,394.83	\$ 29,943.19	\$ 29,968,40	\$ 30,506.95	\$ 35150
Casual Payroll	5,092.43	1,918.98	1,210.28	1,719.78	1000
Superannuation					
Fuel	4,575.05	1,026.82	410.69	76.77	
Power	12,488.45	9, 182.94	8,564.42	10,024.18	9500
Water		5,007.80	4,789.04	3, 199, 99	3500
Chemicals	3,991.86	3,551.07	20, 33	1,564.32	3000
General Supplies	4,029.90	3, 209. 65	2,421.87	2,815.02	2400
Equipment	1, 106. 57	1,473.83	390, 64	673.97	500
Mtc. & Repair	1,189.48	761, 68	2,446.13	5,031,25	2400
Sludge Haulage			9,930.14	13,435.66	11000
Sundry	16,019.52	11, 344. 32	2,823.26		2000
Ins. & Taxes			3,778.18		4300
Travel			377.68	472.13	550
Contingency					
TOTAL	\$ 74,888.15	\$ 67,420.28	\$ 67, 131.06	\$ 72,953.91	\$ 75300









#### Design-Data

#### GENERAL

Screening

Type of Plant - Activated sludge process.

Design Population - 50,000 persons.

Design Plant Flow - 4.0 MGD.

Per Capita Flow - 80 Imperial gallons per day.

Five Day BOD -

Raw Sewage - 150 PPM

Removal - 85 %

Two Griductor Comminutors to cut sewage.

Bar screen on bypass channel.

#### Sewage Lift Pumps

Two - 4 MGD gas powered units.

One - 4 MGD electric powered unit.

#### PRIMARY TREATMENT

#### Primary Sedimentation Tanks

#### Grit Removal

Size - 2 parallel 11.5' x 11.5' x 2.0' liquid depth tanks.

Volume - 3,300 gallons.

Retention - 1.2 minutes.

Velocity - . 163 fps.

Type of Unit - Walker type CRG grit collector with dragout and organic return pump.

Size - 90' x 30' x 10' depth, three units.

Volume - 505,000 gallons total.

Retention - 3 hours.

Surface Settling Rate - 500 gallons per sq. ft. of tank per day.

Weir Rate - 44,000 gallons per lineal ft. per day.

Hardinge Clarifier Mechanisms - for sludge and grease collection.

#### SECONDARY TREATMENT

Sludge collectors are Walker Type RSX circular.

#### Aeration Section

Size - 4 single pass tanks,  $185' \times 20' \times 12'$  liquid depth.

Total volume - 1.1 MG.

Retention - 5.31 hours at 1.25 x design flow.

Air Supply - 1.35 cu. ft. per gallon.

- diffused air.

Five Day BOD Loading - 4,200 pounds per day total.

#### Final Sedimentation Tanks

Size - 2 units,  $60' \times 60' \times 11'$  liquid depth.

Volume - 500,000 gallons.

Retention - 3 hours.

Surface Settling Rate - 550 gallons per sq. ft. per day.

Weir Rate - 8,000 gallons per lineal ft. per day.

#### Chlorine Contact Chamber

Size - 1 circular unit, 34 ft. diameter x 12.5 ft. depth.

Volume - 71,000 gallons.

Retention - 25 minutes.

Chlorinator - 500 lbs. scale. BIF semi-automatic.

#### Outfall

Size - 1,000 ft. of 36 inch diameter steel pipe.

Retention - 16 minutes.

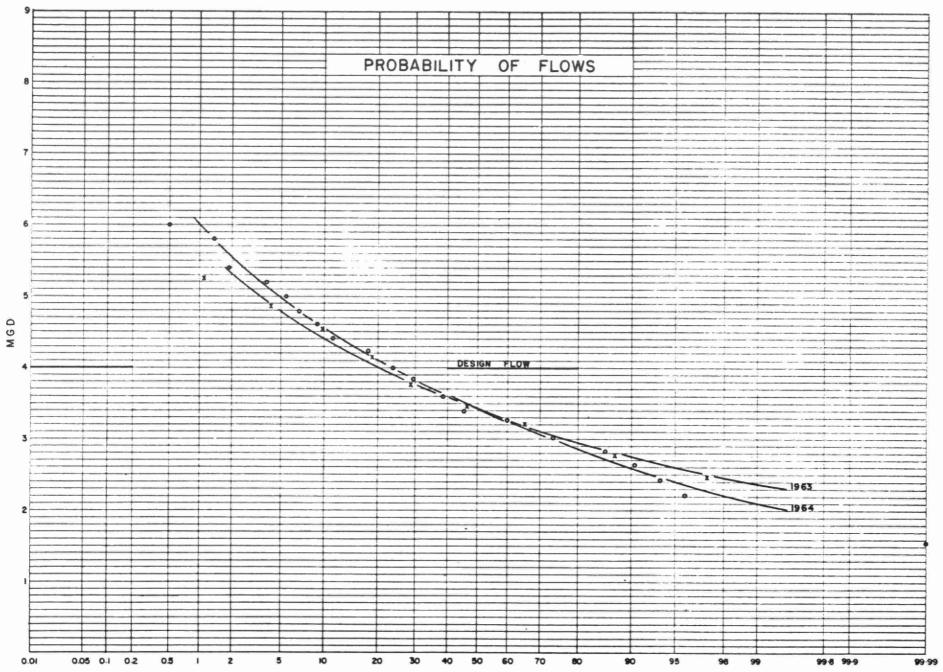
#### Digestion System

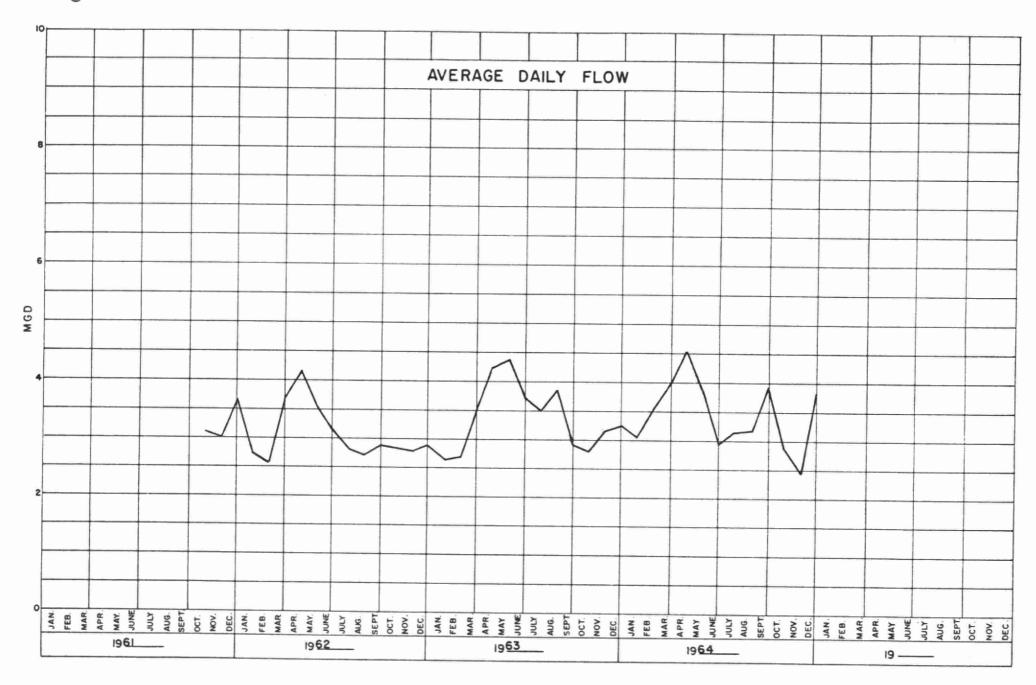
Digesters - 2 units, one with floating cover, 65 ft. diameter each.

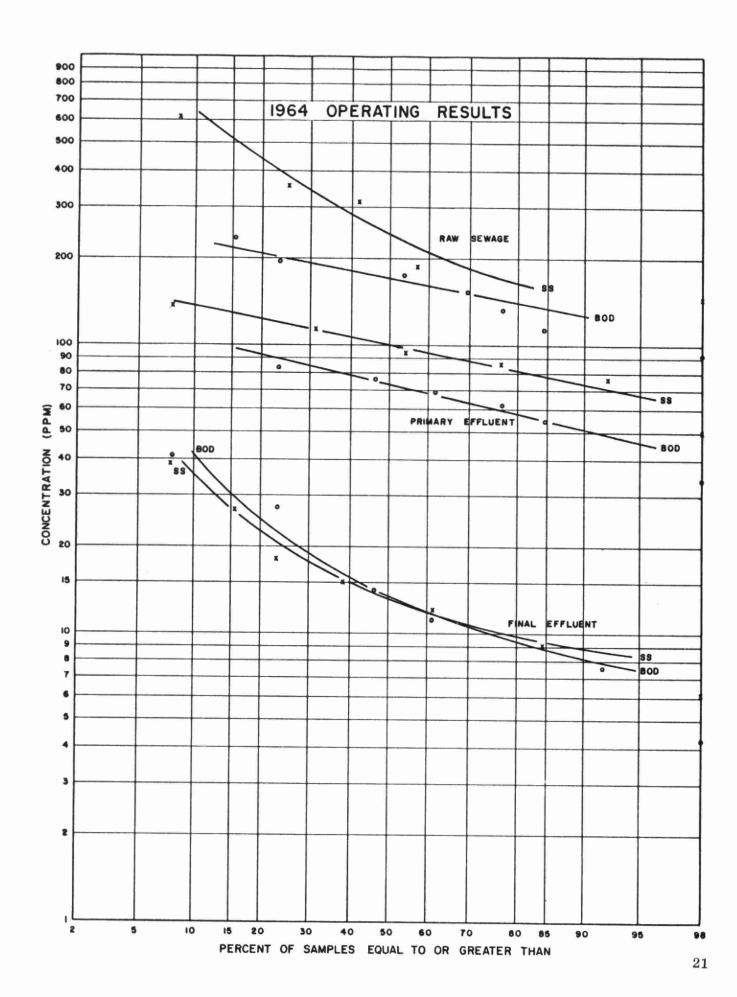
Volume - Primary - 70,000 cu. ft. - Secondary - 74,000 cu. ft.

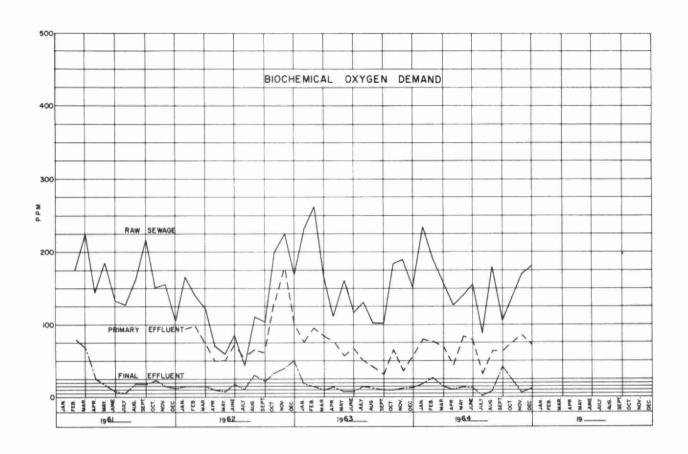
Per Capita Loading - 2.9 cu. ft. per capita.

Mixing - 3 Dorr 5 HP draft tube mixers.

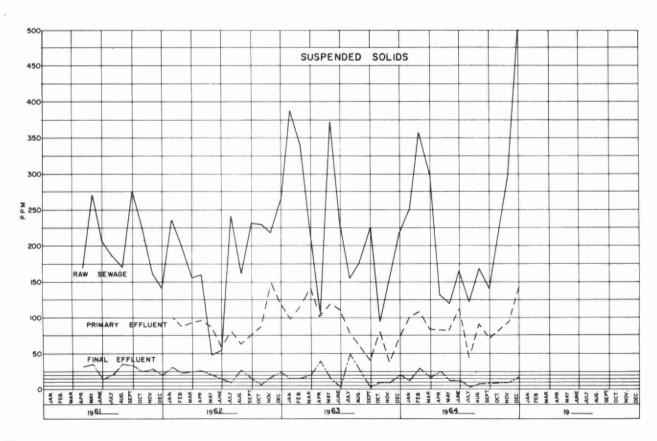








### MONTHLY VARIATIONS



#### GRIT, B.O.D AND S.S. REMOVAL

		8.	O. D.			s	. S.		GRIT
МОМТН	INFLUENT P.P.M.	EFFLUENT PPM.	% REDUCTION	TONS REMOVED	INFLUENT PPM.		% REDUCTION	TONS REMOVED	REMOVAL CU. FT.
JAN.	235	18	92.5	103, 9	252	12	95	114.9	469
FEB	190	26	86.5	86.2	356	28	92	172.3	581
MAR.	155	15	90.5	86.4	302	16	94.5	176.4	807
APR.	125	10.4	91.5	78.1	131	25	81	72.2	721
MAY	140	14	90	75.2	120	12	90	64.4	956
JUNE	155	14	91	62.9	166	12	92.5	68.7	885
JULY	88	2.6	97.0	41.2	124	4	96.5	58.0	863
AUG.	180	8.6	95.0	84.2	168	7	96.0	79.1	770
SEPT.	105	42	60.0	37.5	142	8	94.5	79.7	574
ост.	* 157	15	90.5	61.9	250	14	94.5	102.9	648
NOV.	170	7.6	95.5	59.2	300	10	96, 5	105.7	663
DEC.	180	11	94.0	77.2	694	17	97.5	309.1	604
TOTAL	-	-	-	876.4	-	-	-	1456, 5	8541
AVG.	157	15	90, 5	73.0	250	14	94.5	121.4	712

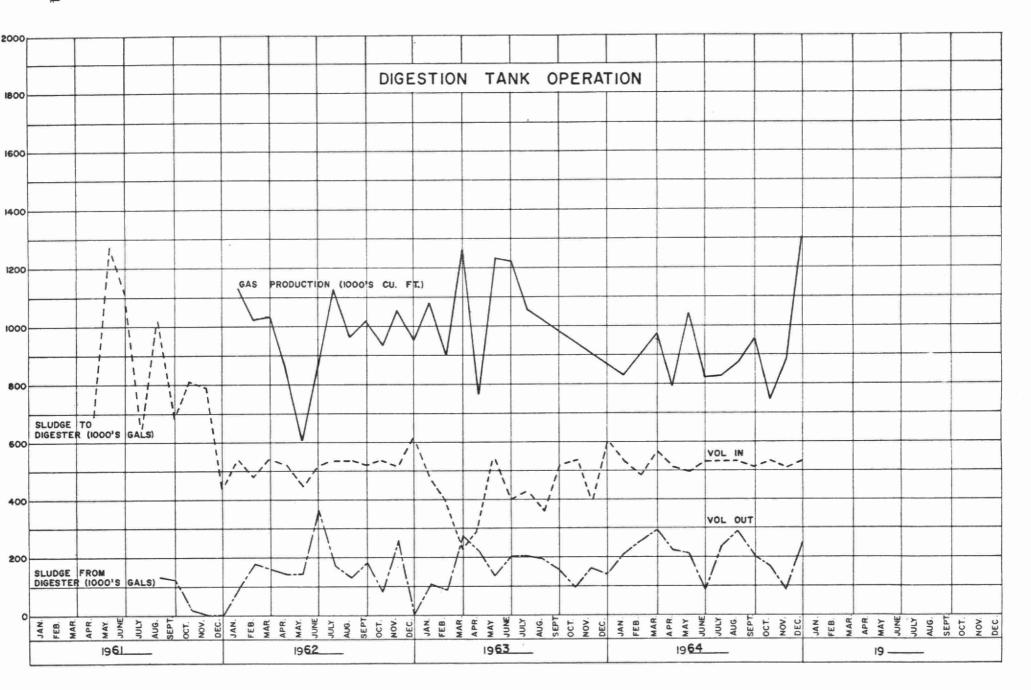
<sup>\*</sup>average values substituted. No sample.

#### COMMENTS

No sewage analysis was made during the month of October, thus average values were inserted to arrive at a total tons of BOD and SS removed.

The percentage reduction of BOD concentration has decreased from 91.5% in 1963 to 90.5% in 1964 while at the same time the percentage reduction of SS concentration has increased from 89.0% in 1963 to 94.5% in 1964. The average concentration of BOD has decreased from 164 ppm in 1963 to 157 ppm in 1964. The average concentration of SS has increased from 229 ppm in 1963 to 250 ppm in 1964. The effluent quality has met OWRC objectives with the average concentrations of BOD and SS being 15 ppm and 14 ppm respectively.

During 1964, grit removal was 6.9 cubic feet per million gallons as compared with 7.4 cubic feet per million gallons in 1963.



#### DIGESTER OPERATION

	SLUDG	E TO DIGESTI	ERS	SLUDGE	SLUDGE FROM DIGESTERS				
MONTH	1000'S CU.FT.	% SOLIDS	% VOL. MAT.	1000'S CU.FT.	% SOLIDS	% VOL. MAT	GAS PRODUCED 1000'S Cu. Ft.		
JAN.	85.85	3.07	-	33, 11	4,03	_	-		
FEB.	77.54	3, 64	-	40.37	1.64	-	* 833, 51		
MAR.	91, 14	2.79	-	46.41	1,55	-	974. 92		
APR.	83.08	1, 27	-	35, 27	1.65	_	799, 42		
MAY	80.31	2,49	1	34.05	1.32	-	1036, 63		
JUNE	83.08	2.70	-	13. 13	5.70	-	822. 37		
JULY	85, 85	2,02	-	37.66	5.95	-	826.09		
AUG.	85.85	1.85	-	46.72	2, 16	_	859. 70		
SEPT.	83.08	-	-	33. 27	0, 28	-	954, 84		
ост.	85.85	- '	-	26.76	-	-	745.87		
NOV.	83,08	5, 17	-	14.06	8.64	-	882.04		
DEC .	85, 85	3, 55	-	39.46	1. 37	_	1305. 28		
TOTAL	1010,56	-	-	400.27	_	-	10953, 46		
AVG.	84, 21	2.86	_	33. 36	3, 12	_	912, 79		

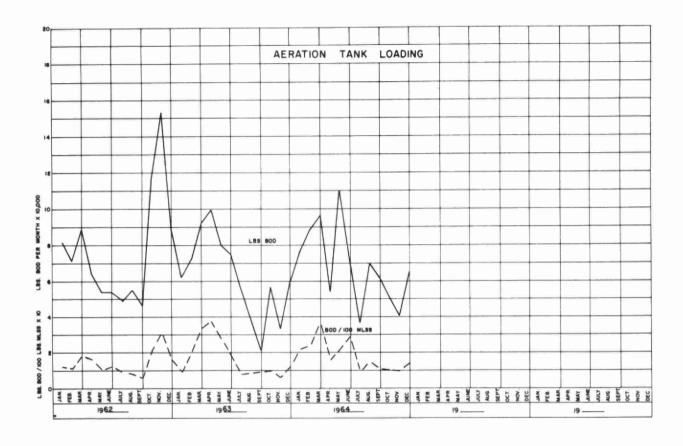
<sup>\*</sup> meter repaired

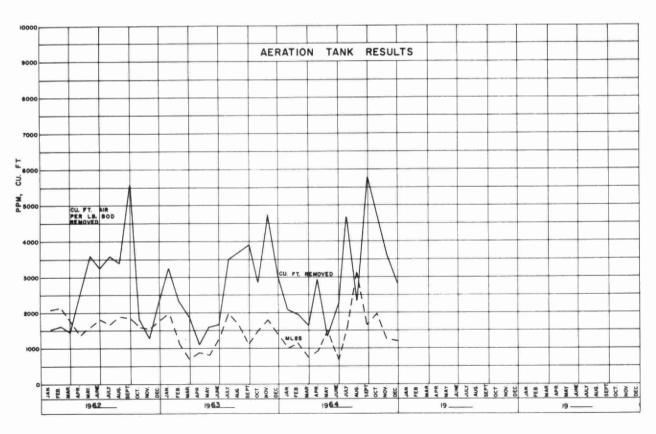
#### COMMENTS

The above data indicates that the sludge solids reduction was approximately 57% which is quite good.

The amount of gas produced is 11.5 cubic feet per pound of sludge solids reduced.

<sup>+</sup> total prorated on 11 months.





#### **AERATION SECTION**

MONTH	PRIM. EFFL B.O.D, P.P.M.	M.L.S.S. P.P.M.	LBS. BOD. PER	CUBIC FEET AIR PER LB. B.O.D. REMOVED
JANUARY	80	1020	22	2079
FEBRUARY	76	1134	24	1987
MARCH	70	748	37	1686
APRIL	44	978	16	2940
MAY	84	1458	22	1357
JUNE	78	700	29	2259
JULY	32	11 22	9	4653
AUGUST	64	1344	15	2377
SEPTEMBER	64	1683	11	5780
OCTOBER	-	1988	-	_
NOVEMBER	86	1282	10	3649
DECEMBER	72	1220	14	2809
TOTAL	-	-		-
AVERAGE	68	1223	19	2598

#### COMMENTS

The values of 1223 ppm for mixed liquor suspended solids and 19 pounds of BOD per 100 pounds mixed liquor suspended solids are within the suggested recommended limits although the values do approach the lower limits.

The value of 2598 cubic feet of air per pound of BOD removed seems to be high. However, as the plant effluent meets the required standard, this high value is attributed to the hydraulic design of the aeration tanks and to the relatively low concentration of mixed liquor suspended solids.

#### **CHLORINATION**

MONTH	PLANT FLOW (MG)	POUNDS CHLORINE	DOSAGE RATE (PPM)
JANUARY	95.773		
FEBRUARY	105,070		
MARCH	123, 379		,
APRIL	136.250		
MAY	119.349		v
JUNE	89, 258		
JULY	96. 621		
AUGUST	98, 255		
SEPTEMBER	118,955		
OCTOBER	87. 229		
NOVEMBER	72, 882		
DECEMBER	91. 307		
TOTAL	1234, 328		
AVERAGE	102, 861		

#### COMMENTS

Chlorination, for purposes of effluent disinfection, is carried on from break-up of ice to freeze-up of the receiving body of water. Chlorine application is effected by automatic proportioning equipment.



